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Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely
upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1) the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
2) other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
3) any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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Technical Memorandum

To: Gregory Myers
AMEC Foster Wheeler

From: Adam P. Sugrue / Sujit K. Bhowmik, PhD, PE / James L. Willmer, PE

Cc: Christopher Jung, EIT, AMEC Foster Wheeler

Date: March 28, 2016

Subject: Summary of Retaining Wall Field Exploration
Proposed Clarkston Streetscape Improvements
Clarkston, DeKalb County, Georgia
Willmer Project No. 71.3983

Willmer Engineering Inc. (Willmer) has completed a field exploration to gather information related to an existing "L-shaped" retaining wall that is within the footprint of a proposed boardwalk located south of Norman Road in Milam Park in the City of Clarkston, DeKalb County, Georgia. The purpose of this technical memorandum is to summarize our observations and findings related to the existing retaining wall (such as type, geometry, depth, etc.), which will be used to evaluate the potential impacts of constructing foundations for the boardwalk adjacent to the wall.

Project Description

The existing retaining wall and proposed boardwalk are located in Milam Park, which is located at about 3867 Norman Road, Clarkston, Georgia. A project location map is presented on Figure 1. The proposed boardwalk is located within the Norman Road corridor of the City of Clarkston Streetscape Improvements project. The Norman Road corridor begins at its intersection with Church Street on the west and extends eastward, ending at the city's boundary with DeKalb County.

The proposed boardwalk begins at the west side of the park at an existing concrete walkway and extends approximately 300 feet to the east, ending at an existing concrete sidewalk near the entrance to the park. The proposed boardwalk will be constructed using timber joists and posts. The design details show the posts will be founded on 1.5 foot diameter concrete shafts extending 1 foot above finished grade and a minimum of 3 feet below finished grade.

As shown on Figure 2, the proposed boardwalk straddles an existing stone masonry retaining wall approximately 180 feet from the beginning of the boardwalk. An image of the retaining wall is presented on Figure 3. The existing "L-shaped" retaining wall is about 25 feet long in the north-south direction and about 55 feet in the east-west direction. The height of the retaining wall varies from about 5.75 feet at the west end to about 6.25 feet at the east end. A 1.5 foot wide, 3 inch thick concrete cap exists on the top of the wall. The retaining wall serves as a headwall for a 36-inch diameter corrugated metal pipe (CMP) culvert at its west end and an inlet for a 60-inch diameter CMP culvert at the approximate middle of the east-west portion of the wall. The sections where the culverts penetrate the wall are shown on Figure 3. Water is conveyed into the 60 inch CMP culvert from the 36-inch diameter CMP culvert and the outlet

structure for Crystal Pond via a ditch running along the south side of Norman Road. Water flowing in the ditch flows along the base of the retaining wall as shown on Figure 3.

Field Exploration

The subsurface exploration for this project consisted of advancing seventeen hand-auger borings (designated HA-1 to HA-17) in the vicinity of the back face of the retaining wall, drilling two Standard Penetration Test (SPT) borings (designated B-1 and B-2) offset about 11 feet perpendicular to the wall alignment, and hand-excavating two test pits adjacent to the back face of the retaining wall. A boring and test pit location plan is presented on Figure 4, and locations of the test pits and hand-auger borings are also shown on the field sketches in Appendix III.

The hand-auger borings were advanced until refusal or were terminated after being advanced to a depth deeper than the observed wall bottom in the ditch on the front side of the wall. Table 1 summarizes the refusal or termination depths and offset distance from the back face of the wall for each hand-auger boring.

The SPT borings were performed about 11 feet from the back face of the wall to characterize the subsurface conditions of the soil retained by the wall. Borings logs from the SPT borings are presented in Appendix I. Groundwater readings could not be taken in the SPT borings due to hole cave-in, but a groundwater reading was taken in an existing piezometer installed approximately 25 feet to the west of the retaining wall. The groundwater was measured at 6 feet below the existing ground surface in the piezometer.

Test pit #1 was approximately 1.5 feet by 1.5 feet square by 3 feet deep and test pit #2 was excavated 1.5 feet long by 1.25 feet wide by 3 feet deep. The purpose of excavating the test pits was to expose the back face of the wall. Photographs of the test pits are presented in Appendix II.

Field Observations

Based on the hand-auger borings and test pits, the existing retaining wall appears to have a vertical back face. Varying hand-auger refusal depths behind the wall indicate the existence of stone/rock layers of varying thickness behind the wall. This stone/rock material may form the base of the wall or it could be a part of the backfill material that was placed behind the wall. The stone/rock material was encountered at depths ranging from 4.5 feet to 5.75 feet below the ground surface behind the wall. This material generally appeared to extend 1 foot to 2.5 feet from the back face of the wall at our hand-auger boring locations. The maximum distance that refusal was encountered away from the back face of the wall was about 4.5 feet at HA-17. Photographs of the retaining wall are included in Appendix II, and field sketches of the retaining wall based on the test pits and interpreting the hand-auger boring refusal depths are included in Appendix III.

The retaining wall showed signs of distress, such as missing mortar between stones, missing stones, cracking between stones, and bowing of the wall away from the retained soil. There did not appear to be any drainage measures behind the retaining wall such as coarse gravel or perforated piping. Apparent erosion was observed at the east end of the retaining wall as shown in the photographs in Appendix II. Riprap was observed at the toe of the wall and geotextile was placed on the slope beyond the east end of the wall to protect against erosion.

The hand-auger and SPT borings revealed that the fill soil retained by the wall generally consists of reddish brown or brownish red silty sand, sandy silt, or sandy clay. Thus, the soil placed directly against the front

face of the wall contains fine-grained soil particles and does not appear to be free-draining. Gray silty sand was generally encountered about 6 inches above refusal elevations adjacent to the wall in hand-auger borings. Gray silty sand with gravel or sandy gravel was encountered in boring B-1 between 6 feet below the ground surface and the boring termination depth (9 feet below the existing ground surface). Gray silty sand was encountered in borings B-1 between 6 feet and 7.5 feet below the existing ground surface.

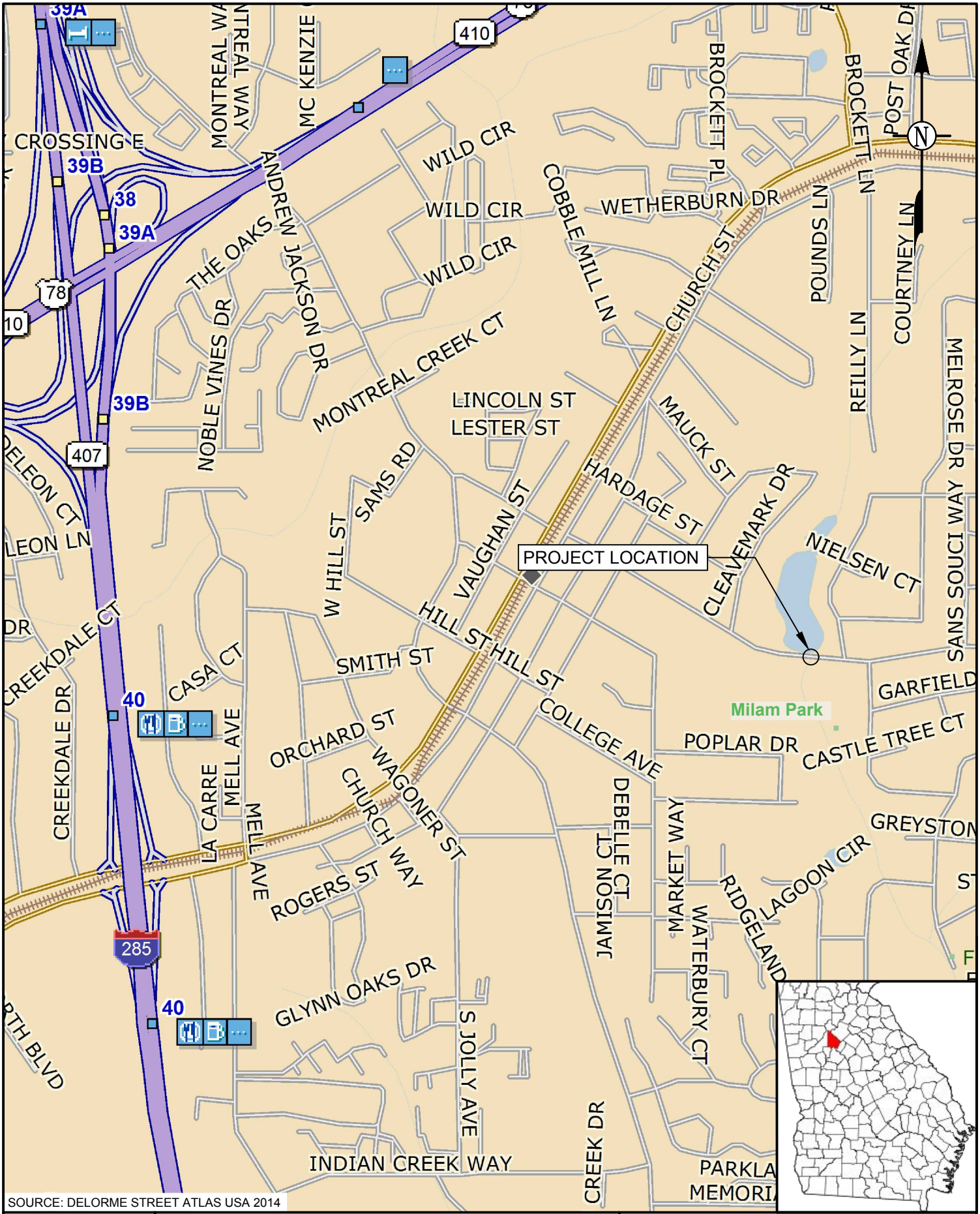
TABLES

Table 1

Summary of Hand-Auger Boring Refusal Depths and Distances from Retaining Wall
City of Clarkston Streetscape Improvements
Clarkston, DeKalb County, Georgia
Willmer Engineering Project No. 71.3983

Section	Boring	Distance From Retaining Wall (feet)	Refusal Depth (feet)	Termination Depth (feet)
A-A'	HA-1	0.5	4.5	
	HA-2	1	5.5	
	HA-3	1.5	5.5	
	HA-4	2.5		8
B-B'	HA-13	0.6	5.2	
	HA-14	1	5.2	
	HA-15	1.5	5.8	
	HA-16	3	5.8	
	HA-17	4.4	6.2	
C-C'	HA-5	0.4	5.5	
	HA-6	1	5.5	
	HA-10	1.5		7
	HA-11	2		7
	HA-12	2.5	5.2	
D-D'	HA-7	0.5	5.75	
	HA-8	1.5	5.75	
	HA-9	2.25		7

FIGURES



SCALE: 1" = 1000'	
DATE: 3/22/2016	
DRAWN BY: AC	
REVIEWED BY: BD	

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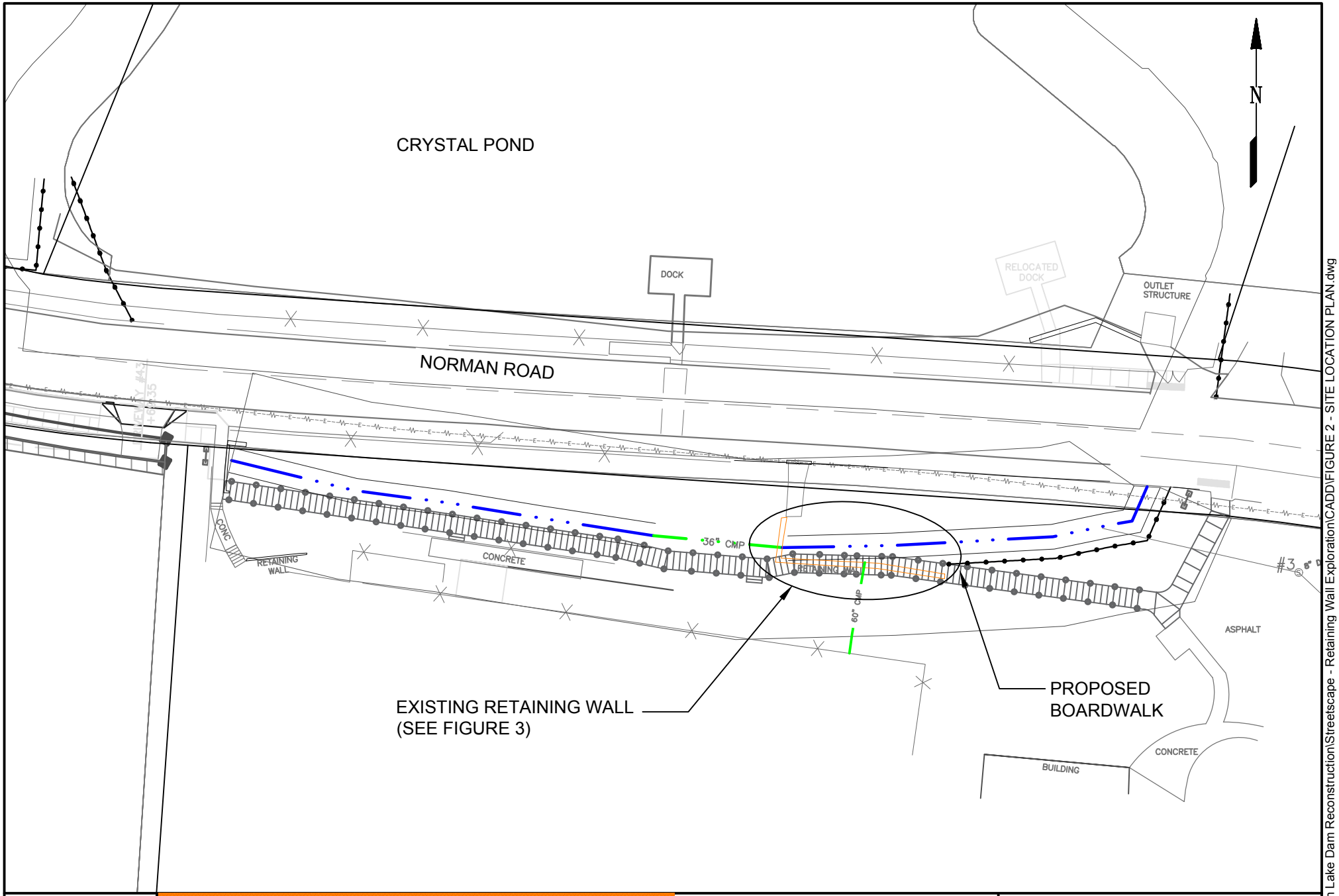
GEOTECHNICAL ENGINEERING
CONSTRUCTION SERVICES
ENVIRONMENTAL SERVICES AND ENGINEERING
3772 PLEASANTDALE ROAD - SUITE 165
ATLANTA, GA 30340-4270

FIGURE 1
PROJECT LOCATION MAP
RETAINING WALL FIELD EXPLORATION
CLARKSTON LAKE DAM RECONSTRUCTION
CLARKSTON, DEKALB COUNTY, GEORGIA
WILLMER PROJECT No. 71.3983

P:\3983 Clarkston Lake Dam Reconstruction\Streetscape - Retaining Wall Exploration\CADD\project location map.dwg



SCALE: 1" = 50'	
DATE: 3/11/2016	
DRAWN BY: CO	
REVIEWED BY: APS	

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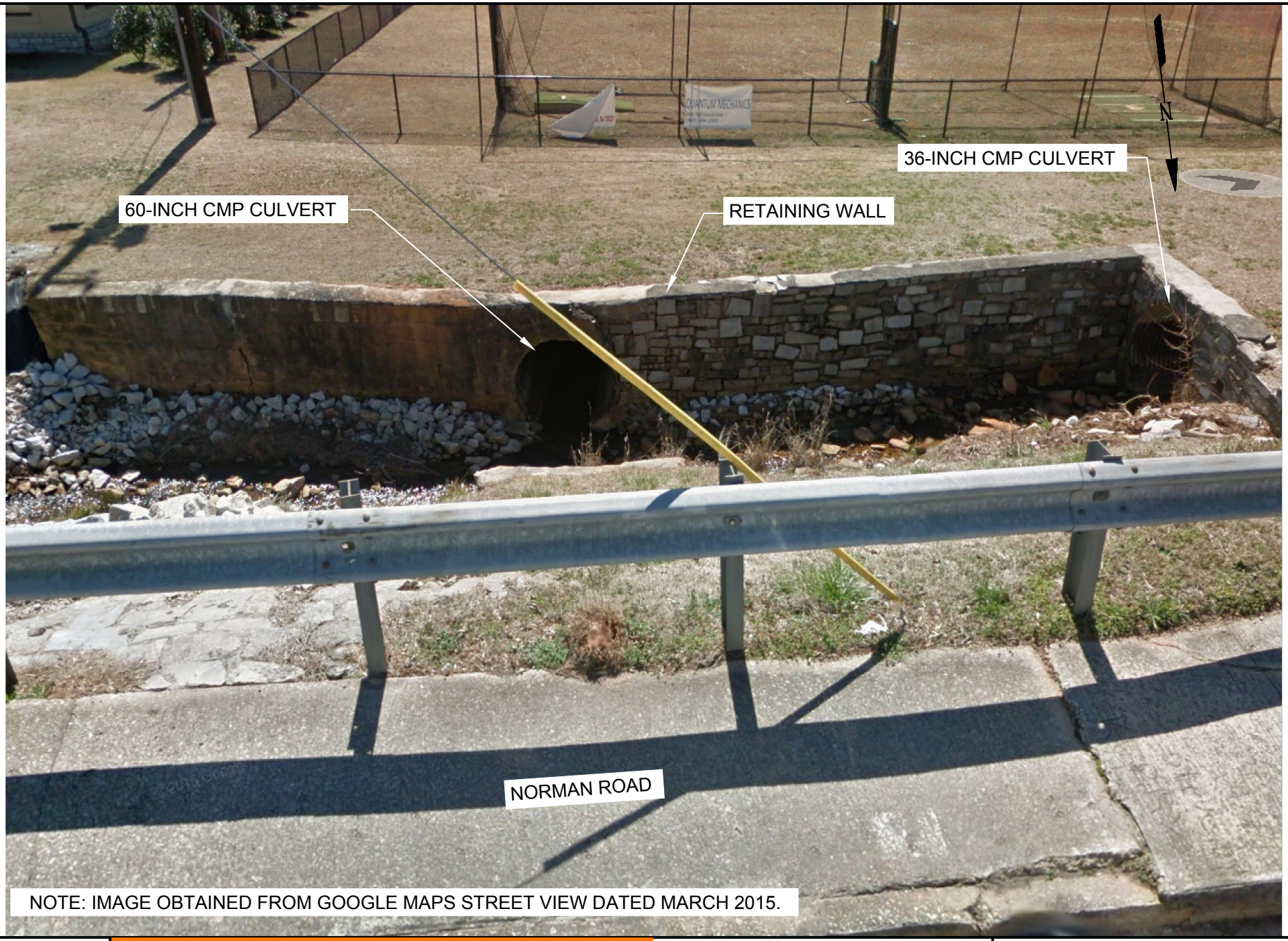
3772 PLEASANTDALE ROAD - SUITE 165
ATLANTA, GA 30340-4270

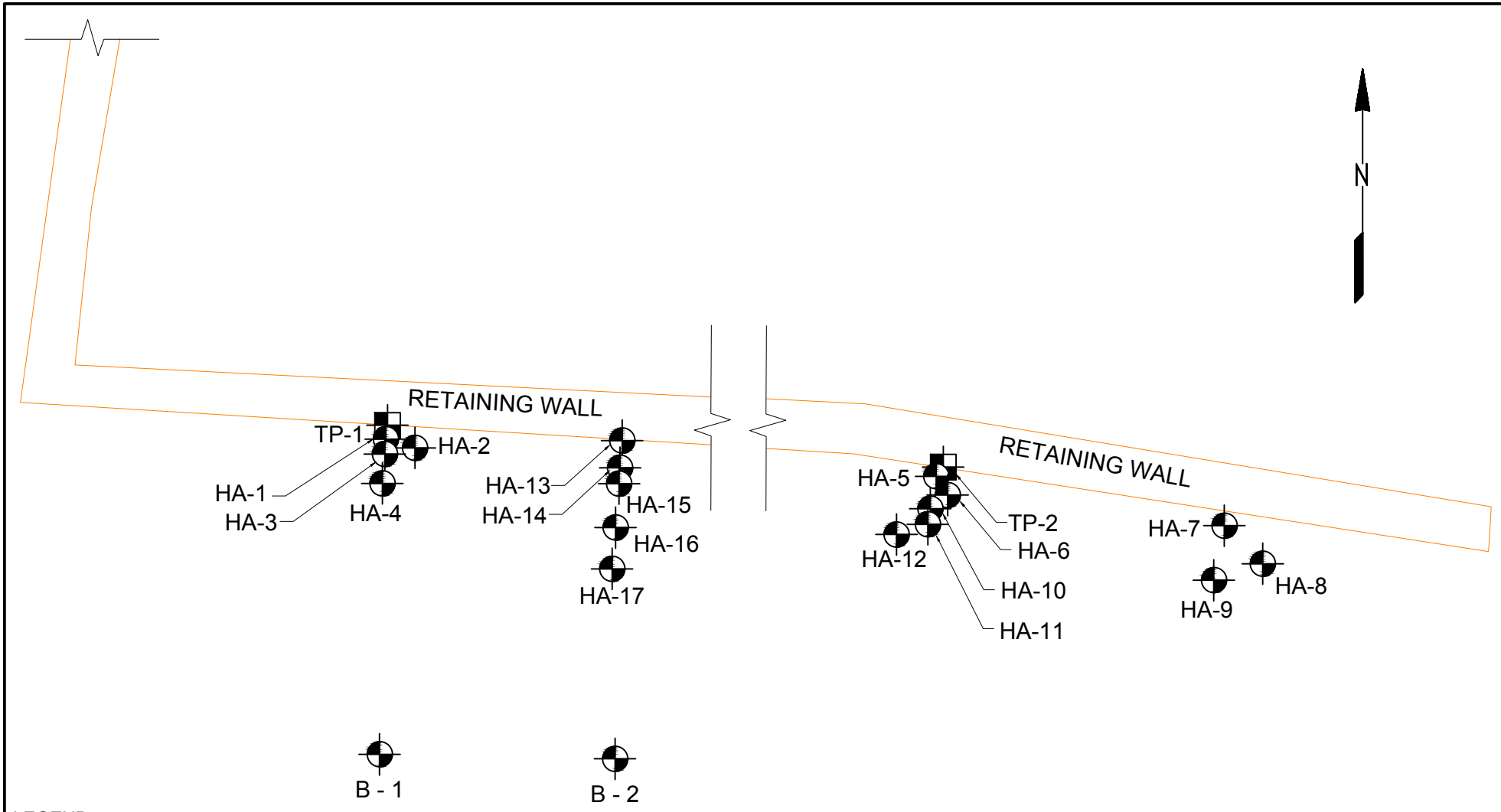
FIGURE 2
SITE LOCATION PLAN
RETAINING WALL FIELD EXPLRATION
CLARKSTON STREETSCAPE IMPROVEMENTS
CLARKSTON, DEKALB COUNTY, GEORGIA
WILLMER PROJECT No. 71.3983

P:\3983 Clarkston Lake Dam Reconstruction\Streetscape - Retaining Wall Exploration\CADD\FIGURE 2 - SITE LOCATION PLAN.dwg



SCALE: NTS DATE: 3/10/2016 DRAWN BY: APS REVIEWED BY: SKB	WILLMER ENGINEERING INC. WE	GEOTECHNICAL ENGINEERING ¤ CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	FIGURE 3 RETAINING WALL IMAGE RETAINING WALL FIELD EXPLORATION CLARKSTON STREETSCAPE IMPROVEMENTS CLARKSTON, DEKALB COUNTY, GEORGIA WILLMER PROJECT No. 71.3983

P:\3983 Clarkston Lake Dam Reconstruction\Streetscape - Retaining Wall Exploration\CADD\FIGURE 3 - RETAINING WALL IMAGE.dwg



LEGEND:

HA-1 HAND AUGER BORING LOCATION

TP-1 TEST PIT LOCATION

B - 1 SPT BORING LOCATION

NOTE: SEE FIELD SKETCHES FOR TEST PIT DIMENSIONS AND BORING DISTANCES FROM WALL.

SCALE: 1" = 5'	WILLMER ENGINEERING INC. WE	GEOTECHNICAL ENGINEERING ¤ CONSTRUCTION SERVICES ENVIRONMENTAL SERVICES AND ENGINEERING 3772 PLEASANTDALE ROAD - SUITE 165 ATLANTA, GA 30340-4270	FIGURE 4 BORING LOCATION PLAN RETAINING WALL FIELD EXPLORATION CLARKSTON STREETSCAPE IMPROVEMENTS CLARKSTON, DEKALB COUNTY, GEORGIA WILLMER PROJECT No. 71.3983
DATE: 3/7/2016			
DRAWN BY: CO			
REVIEWED BY: AS			

P:\3983 Clarkston Lake Dam Reconstruction\Streetscape - Retaining Wall Exploration\CADD\FIG 4 - BORING LOCATION PLAN.dwg

APPENDIX I

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BORING RECORD LEGEND

SM, CL, etc: - GROUP SYMBOL based on Unified Soil Classification System.
(Refer to ASTM D-2488 and Table 1 of D-2487)

N-VALUE: BLOWS PER FOOT- Standard Penetration Resistance (SPT) blow count , the sum of the second and third 6-inch increments of the SPT test.
(Refer to ASTM D-1586)

CONSISTENCY / RELATIVE DENSITY Correlated with SPT Blow Count, N:

SILTS AND CLAYS

N (blows per foot)	Consistency
0 - 2	Very Soft
3 - 4	Soft
5 - 8	Firm
9 - 15	Stiff
16 - 30	Very Stiff
31 - 50	Hard
> 50	Very Hard

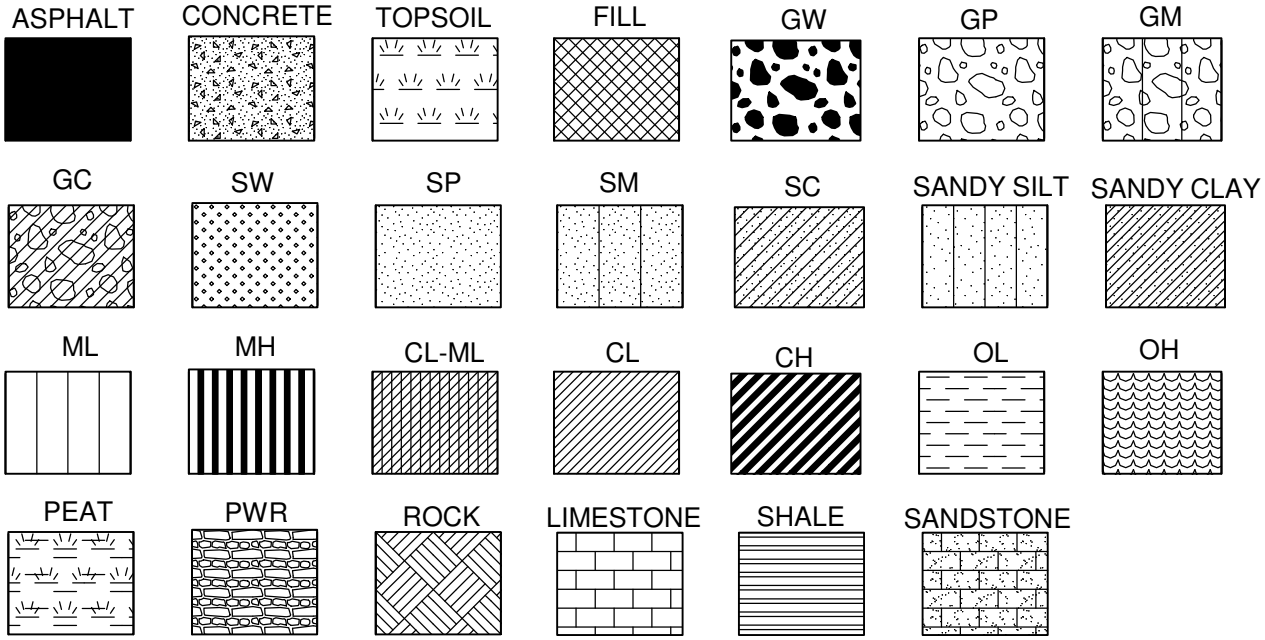
SANDS

N (blows per foot)	Relative Density
0 - 4	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

NOTES:

Groundwater Measurements:

- Water level at 24 hours
- Water level at time of boring
- Caved level at 24 hours



WILLMER ENGINEERING INC.

Willmer Engineering Inc.
3772 Pleasantdale Road, Suite 165
Atlanta, Georgia 30340

UNIFIED SOIL CLASSIFICATION SYSTEM REFERENCE SHEET

MAJOR DIVISIONS			LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED #4 SIEVE	CLEAN GRAVELS LITTLE OR NO FINES	**(GW)**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			(GP)	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES APPRECIABLE AMOUNT OF FINES	**(GM)**	SILTY GRAVELS and GRAVEL-SAND-SILT MIXTURES
			(GC)	CLAYEY GRAVELS and GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING #4 SIEVE	CLEAN SAND LITTLE OR NO FINES	**(SW)**	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			(SP)	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES APPRECIABLE AMOUNT OF FINES	**(SM)**	SILTY SANDS and SAND-SILT MIXTURES
			(SC)	CLAYEY SANDS and SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		**(ML)**	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR VERY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			(CL)	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			(OL)	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		**(MH)**	INORGANIC ELASTIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS
			(CH)	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			(OH)	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			**(PT)**	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

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FIELD PROCEDURES

Standard Procedures for Standard Penetration Test Boring (ASTM D1586)

In this process, a 2-foot long, 2-inch outside-diameter split-barrel sampler attached to the end of a string of drilling rods is driven 18 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The blows required for the first 6 inches of penetration are allowed for seating the sampler into any loose cuttings, and the sum of the blows required for penetration of the second and third 6-inch increments constitutes the penetration resistance or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties including consistency, relative density, strength, compressibility and potential for difficult excavation. Correlations between the N-value and the relative density of cohesionless soils (sands) and consistency of cohesive soils (clays/silts) are included in this appendix.

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Project: **Retaining Wall Exploration - Clarkston Streetscape Improvements**
Location: **DeKalb County, Georgia**
Project Number: **71.3983**

HOLE No. B-1
Sheet 1 of 1
Location: **N/A**

Azimuth: **--** Angle from Horizontal: **90** Surface Elevation (ft): **1026.00** Station: **N/A**

Drilling Equipment: **CME 45** Drilling Method: **HSA Automatic Hammer**

Core Boxes: **N/A** Samples: **5** Overburden (ft): **N/A** Rock (ft): **N/A** Total Depth (ft): **9.0**

Logged By: **AS** Date Drilled: **2/8/16**

VERTICAL DEPTH (ft)	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION		ELEVATION (feet)	N-VALUE
	SPT			TOPSOIL = 4"	SM	1026.0	
	SPT			FILL: Loose reddish brown silty medium to fine **SAND** (micaceous)	SC	1025	6
	SPT				SM		4
5	SPT			Very loose reddish brown with tan silty clayey medium to fine **SAND** (slightly micaceous)	ML		2
	SPT				SM	1020	7
	SPT			Very loose gray fine sandy **SILT**	GP		2
				ALLUVIUM: Loose gray silty coarse to fine **SAND** with coarse to fine gravel			
				Very loose gray and light brown sandy **GRAVEL** with cobbles			
				Boring was terminated 9' feet below the existing ground surface.			
				Groundwater depth could not be measured because the hole caved in 6.4 feet below the existing ground surface.			

STANDARD PENETRATION TEST DATA (blows/foot)
5 10 20 40 60 80

SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
NQ - Rock Core, 1-7/8"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-1**

SPTN 3983 STREETSCAPE LOGS.GPJ 3/22/16

WILLMER ENGINEERING INC. | WE

Project: **Retaining Wall Exploration - Clarkston Streetscape Improvements**
Location: **DeKalb County, Georgia**
Project Number: **71.3983**

HOLE No. B-2

Sheet 1 of 1
Location: **N/A**

Azimuth: **--** Angle from Horizontal: **90** Surface Elevation (ft): **1026.00** Station: **N/A**
Drilling Equipment: **CME 45** Drilling Method: **HSA Automatic Hammer**
Core Boxes: **N/A** Samples: **5** Overburden (ft): **N/A** Rock (ft): **N/A** Total Depth (ft): **9.0**
Logged By: **AS** Date Drilled: **2/8/16**

VERTICAL DEPTH (ft)	GRAPHIC LOG	SAMPLE TYPE	REC%	RQD %	MATERIAL DESCRIPTION	ELEVATION (feet)	N-VALUE
		SPT			TOPSOIL = 4"	1026.0	5
		SPT			Loose brownish red fine sandy **SILT** (slightly micaceous) **ML**	1025	3
5		SPT			Very loose gray and reddish brown sandy **CLAY** (slightly micaceous)		3
		SPT			ALLUVIUM: Loose gray and reddish brown silty coarse to fine **SAND** with coarse to fine gravel **SM**	1020	6
		SPT			Very loose reddish brown fine sandy **SILT** **ML**		1
					Boring was terminated 9' feet below the existing ground surface.		
					Groundwater depth could not be measured because the hole caved in 6.5 feet below the existing ground surface.		

STANDARD PENETRATION TEST DATA (blows/foot)
5 10 20 40 60 80

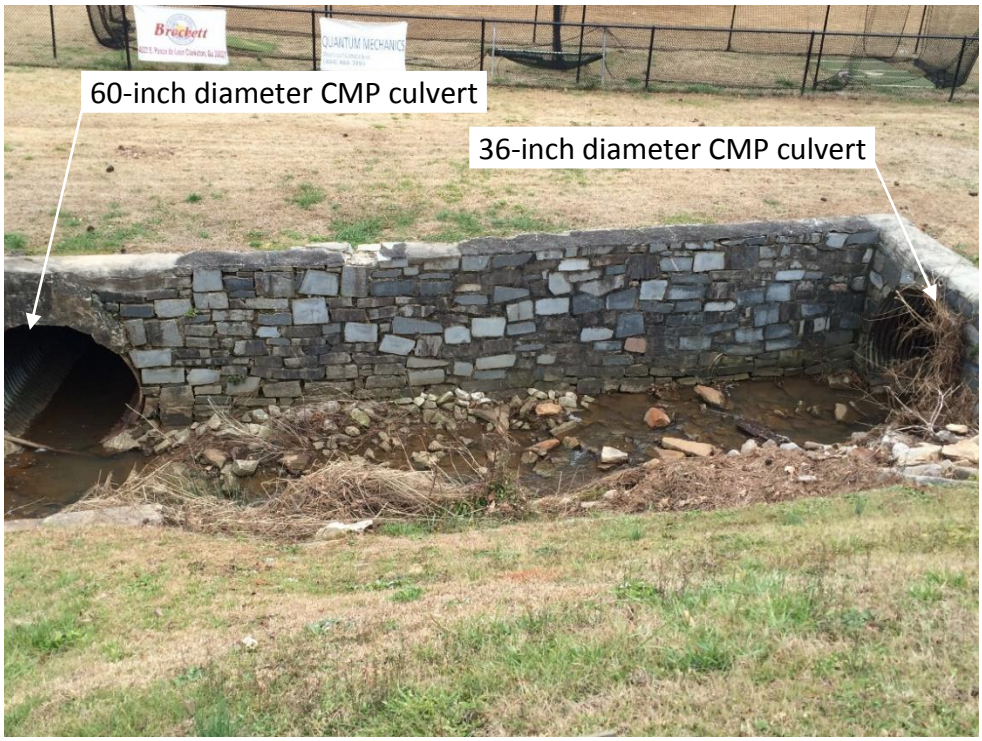
SAMPLER TYPE
SS - Split Spoon
ST - Shelby Tube
NQ - Rock Core, 1-7/8"
NX - Rock Core, 2-1/8"
CU - Cuttings
CT - Continuous Tube

DRILLING METHOD
HSA - Hollow Stem Auger
CFA - Continuous Flight Augers
DC - Driving Casing
RW - Rotary Wash
RC - Rock Core

Hole No. **B-2**

SPTN 3983 STREETSCAPE LOGS.GPJ 3/22/16

APPENDIX II



West End of Retaining Wall, looking south

West End of Retaining Wall, looking southwest

East End of Retaining Wall, looking south

Apparent erosion at east end of retaining wall, looking southwest

Cracking at east end of retaining wall, looking south

Retaining wall, looking west.

Top view of Test Pit #1

Side view of Test Pit #1

Top view of Test Pit #2

Side view of Test Pit #2

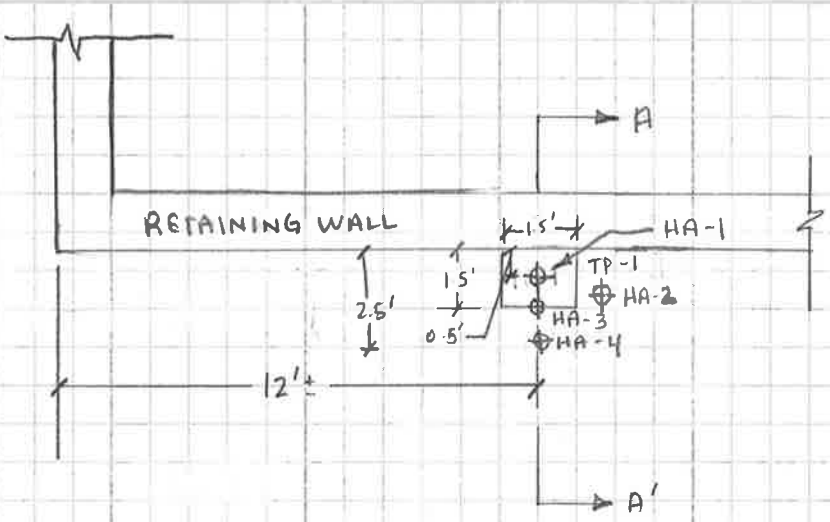
APPENDIX III

WILLMER ENGINEERING INC. | WE

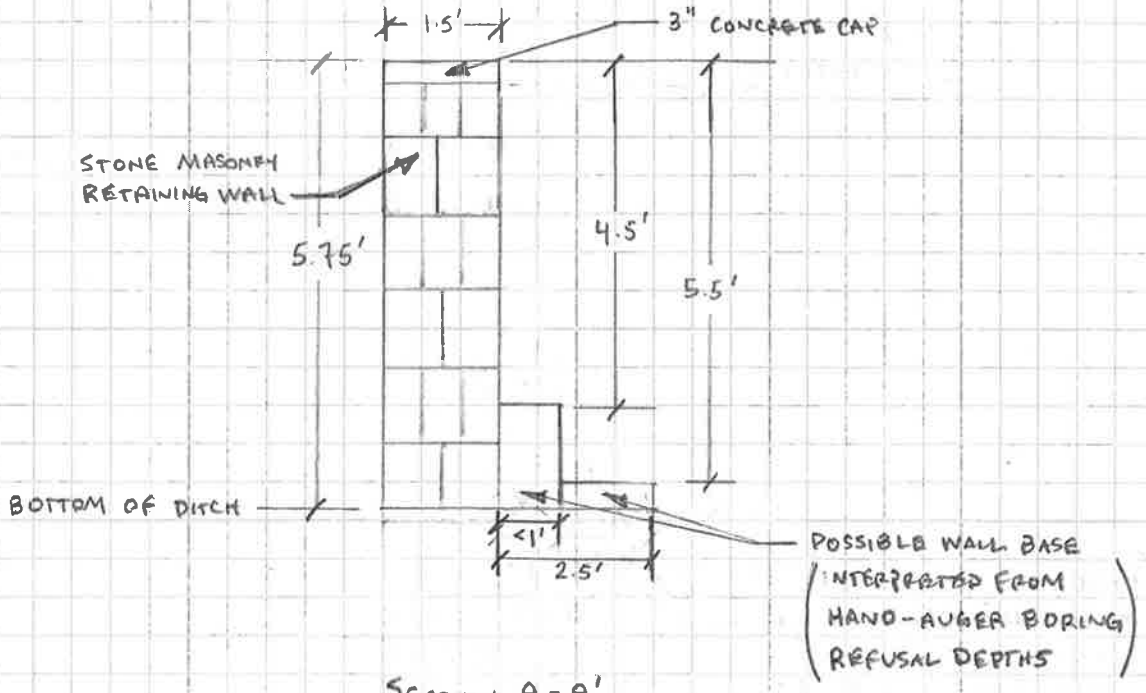
PROJECT NUMBER: 71.4099 PAGE: 1 OF: 4

PROJECT NAME: CLARKSTON STREETSCAPE BY: APS DATE: 2/8/16

SUBJECT: RETAINING WALL SECT. 1 CHK'D: APS DATE: 3/16/16



PARTIAL PLAN
NTS



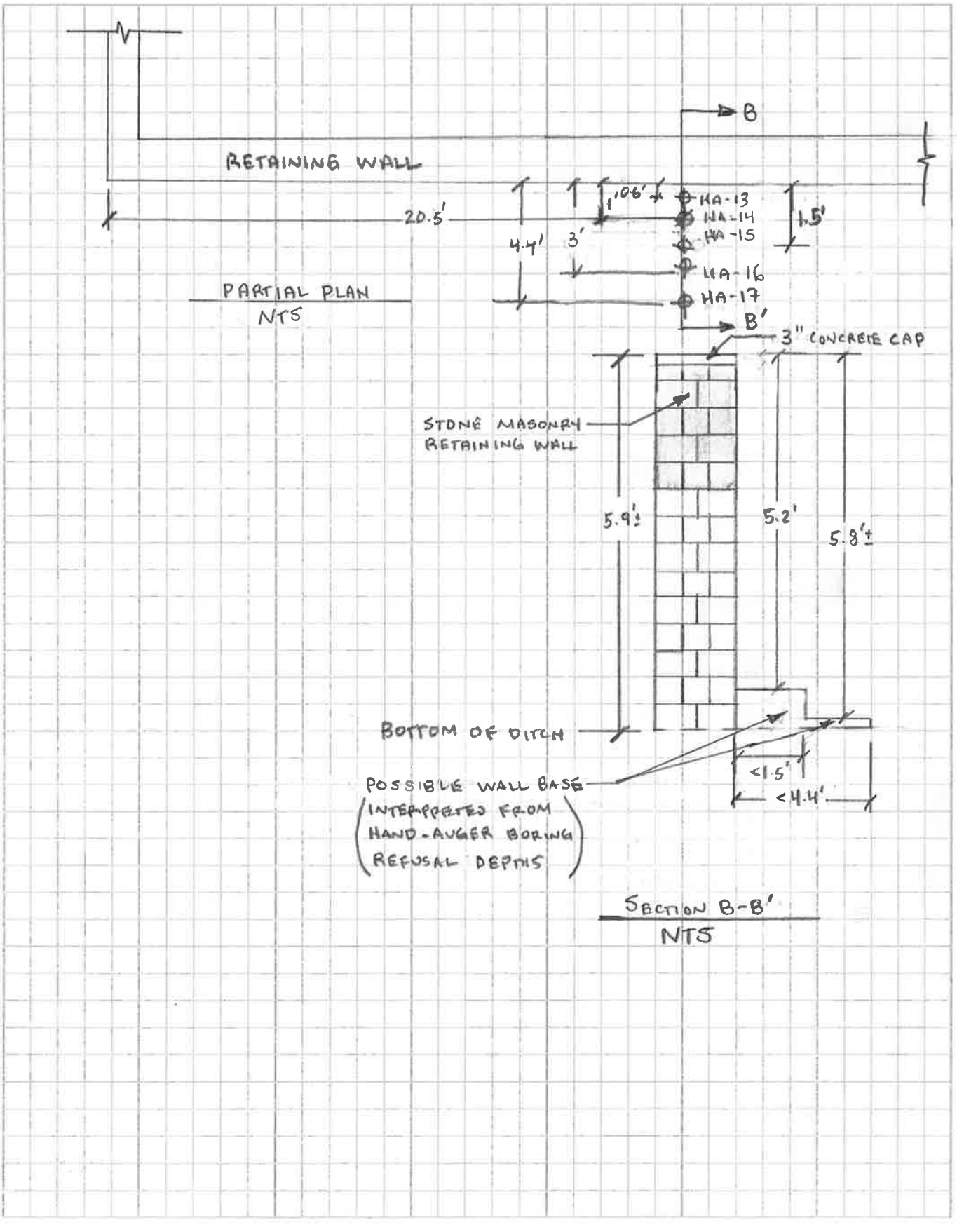
SECTION A-A'
NTS

WILLMER ENGINEERING INC. | WE

PROJECT NUMBER: 71.4097 PAGE: 2 OF: 4

PROJECT NAME: CLARKSTON STREETSCAPE BY: MPS DATE: 2/5/16

SUBJECT: RETAINING WALL SECT. 2 CHK'D: SKB DATE: 3/16/16

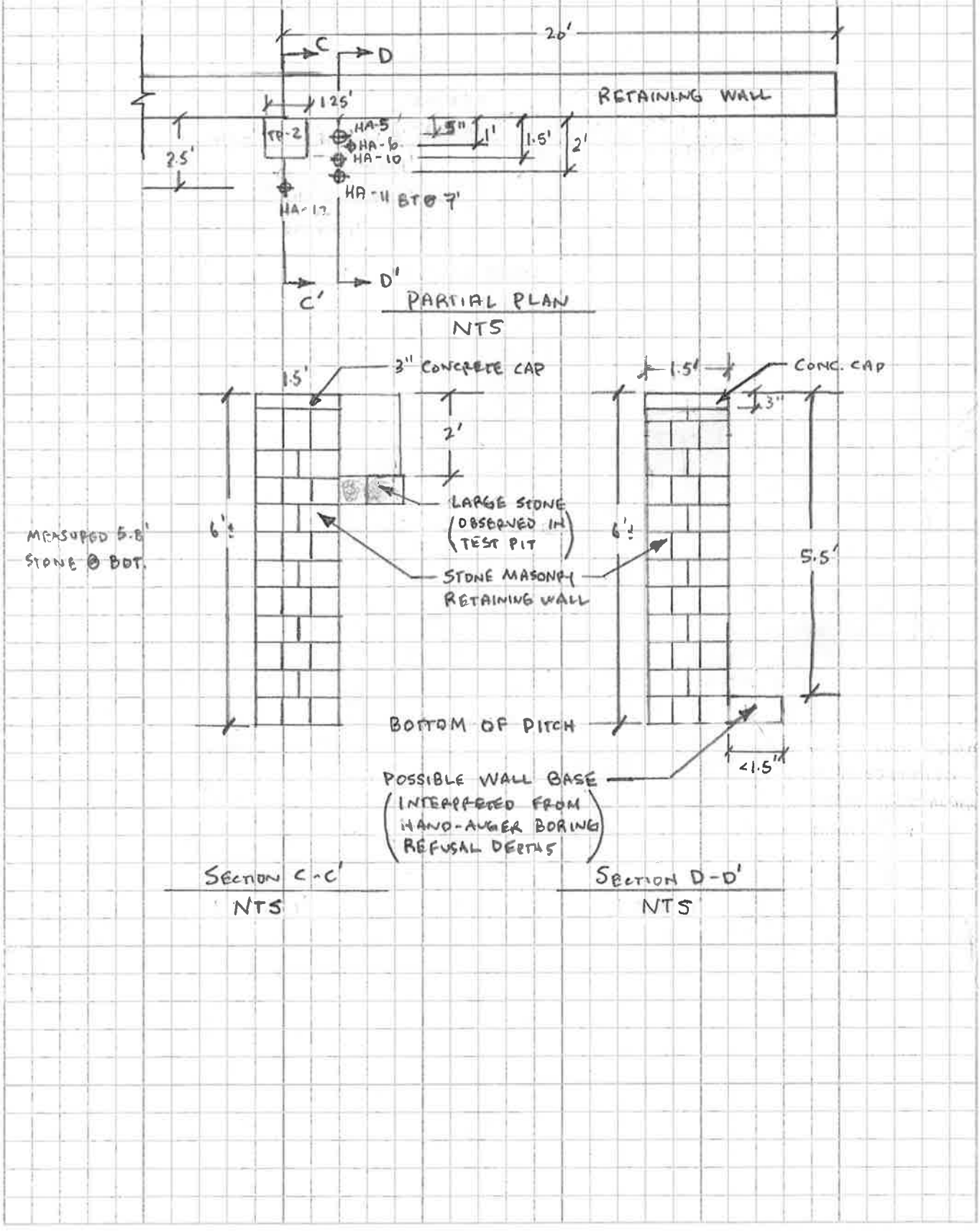


WILLMER ENGINEERING INC. | WE

PROJECT NUMBER: 71.4097 PAGE: 3 OF: 4

PROJECT NAME: CLARKSTON STREETSCAPE BY: APS DATE: 2/8/16

SUBJECT: RETAINING WALL - SECT. 3 CHK'D: SKB DATE: 3/16/16

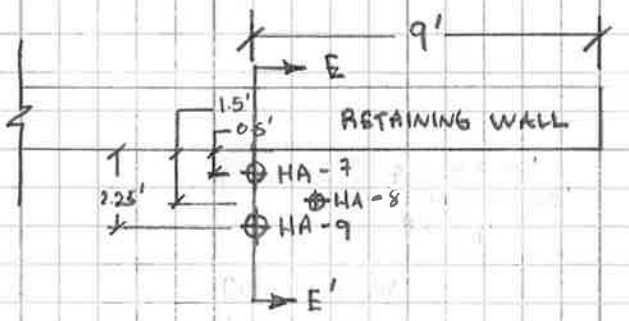


WILLMER ENGINEERING INC. | WE

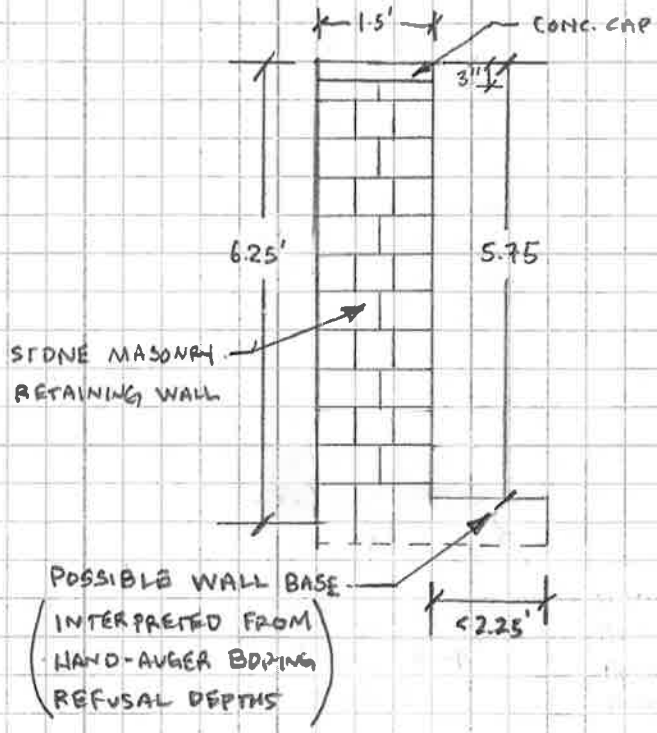
PROJECT NUMBER: 71.4099 PAGE: 4 OF: 4

PROJECT NAME: CLARKSTON STREETSCAPE BY: APS DATE: 2/5/16

SUBJECT: RETAINING WALL SECT. 4 CHK'D: _____ DATE: _____



PARTIAL PLAN
NTS



SECTION E-E'
NTS